epitrends

A Monthly Bulletin on Epidemiology & Public Health Practice in Washington State

High-tech Tools of the Trade:

State Epidemiologists Investigate Foodborne Illness Through DNA Fingerprinting and Computer Analyses

Epidemiological investigations to identify the bacterial strain in an outbreak of foodborne illness and its source are increasingly relying on DNA "fingerprinting" (Figure 1) and sophisticated computer analyses linked to a national computer network called PulseNet. This network, developed and maintained by the Centers for Disease Control and Prevention, allows scientists from public health laboratories (PHL) throughout the country to rapidly compare bacterial isolates and determine whether illness among persons in different regions may be caused by a widely distributed contaminated food product. The Washington State Public Health Laboratories have

played a key role in developing and testing these techniques (see sidebar on page 2). Our labs also had a significant role in the development of PulseNet.

DNA Fingerprinting

The ability to determine relatedness among bacterial isolates involved in an infectious disease outbreak is extremely useful for epidemiological investigations. Unfortunately, classic typing methods based on phenotype such as bacteriophage susceptibility, antimicrobial susceptibility profiles, metabolic enzyme profiles, and serotyping generally fail to adequately discriminate between related outbreak strains.

Since the early 1990s, significant effort has been directed toward developing nucleic acid-based typing methods that would be suitable for use in clinical and Continued page 2

Thousands of Citizens Request Hanford Thyroid Dose Estimates

The recently released draft report of the 9-year Hanford Thyroid Disease Study revealed no evidence of a dose-response relationship between iodine-131 doses from Hanford and thyroid disease. Nevertheless, interest in receiving individual dose estimates has not decreased.

More than 9,000 persons who lived in Eastern Washington, northeastern Oregon, and northern Idaho from December 26, 1944 through December 31, 1957 have returned forms to request their individual estimated doses of airborne iodine-131 released during these years. Once they receive their estimates they may seek more

Continued page 4

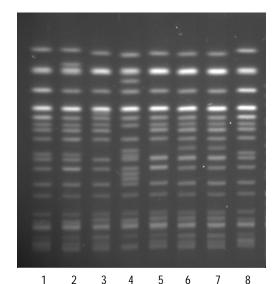


Figure 1: This image shows DNA "fingerprints" of eight different isolates of *E. coli* 0157:H7 bacteria, each in its own vertical "lane." Lanes 6 and 7 are the fingerprints of bacteria from two children who had identical patterns. This result indicates that the two children were infected with the same strain of *E. coli* 0157:H7— strong evidence that the children had a common exposure.

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For More Information

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DNA Fingerprinting (from page 1)

public health laboratories and would enhance the ability of epidemiologists to investigate relatedness of bacterial strains. Pulsed-field gel electrophoresis (PFGE) is one such approach that has emerged as the most widely used subtyping procedure. It characterizes isolates of bacteria below the species level by displaying their molecular genotypes and can be used on a wide variety of significant pathogens.

The process involves embedding bacteria in agarose plugs where they are lysed to release intact chromosomal DNA. Then, judiciously selected endonucleases (enzymes) are used to digest the bacterial DNA to produce 10 to 20 fragments. A "pulsed" electrical field transmitted across the agarose gel causes the DNA fragments to migrate according to their molecular weight; smaller fragments move more quickly than the larger segments. The resulting DNA fragment profiles can be visualized by staining with ethidium bromide. These so-called DNA "fingerprints" fluoresce under ultraviolet illumination and show patterns that are highly specific for organisms of interest. This process allows scientists to examine multiple variations throughout the genome of the organism and to identify specific strains and link them with disease outbreaks.

A National Computer Network

To enhance the role of public health laboratories in foodborne disease surveillance, the CDC in 1995 adopted DNA fingerprinting by PFGE as the molecular subtyping tool for epidemiologic investigations. CDC established a regional network of four state public health laboratories — in Washington, Massachusetts, Minnesota, and

Washington State PHL at Forefront of Advances

Initially, the standard subtyping method for PFGE protocols involved time-consuming and tedious steps. This multiday procedure precluded the use of this highly powerful technology in monitoring the often-rapid evolution of events during outbreaks. However, a recent advancement in the PFGE test developed at the Washington State PHL allows the procedure to be completed in just one day and allows disease investigators to respond in real time. Development of this new method has reduced the interval required to identify and control foodborne outbreaks. This procedure is now part of the national subtyping protocol being used in PulseNet laboratories.

Texas, plus the U.S. Department of Agriculture laboratories. Laboratory scientists began establishing a national database of PFGE pattern subtypes for *E. coli* O157:H7 and other bacteria that cause foodborne illnesses. During the past two years, more than 20 state PHLs have joined this PulseNet surveillance system.

Results from a PFGE test generated by a participating laboratory are digitized as an electronic file and transmitted to the CDC PulseNet server in Atlanta. CDC scientists are immediately able to view the fingerprints and compare them with the national database and add any new patterns. In the next step of PulseNet's development, a laboratory submitting a pattern will be able to access associated epidemiologic information. If different laboratories submit identical PFGE patterns within a preselected period, the PulseNet computer will be able to generate automatic e-mail warmings of a possible multistate epidemic.

With the participation of the USDA and Food and Drug Administration in PulseNet, it is possible to monitor for illnesses attributable to *E.coli* O157:H7, *Salmonella*, and *Listeria* strains isolated from food already in distribution. PulseNet labs can retrieve PFGE patterns of food isolates from the CDC site and compare them with patterns from suspect cases possibly exposed to the contaminated food. The rapid identification of these connections enables epidemiologists to detect outbreaks and remove contaminated food from the marketplace before widespread disease occurs.

Domoic Acid in Razor Clams Still Poses a Health Risk

Levels of domoic acid in razor clams from coastal beaches have dropped since the record-high levels of last fall (see October 1998 *epiTRENDS*), but are still unsafe for consumption. All of Washington's ocean beaches remain closed to recreational harvesting of razor clams.

Harvesting of clams is banned when domoic acid levels are above 15 ppm. As of March 1, routine testing showed levels of 142 ppm at Kalaloch North Beach (down from 295 ppm in November), 48 ppm at Twin Harbors, 45 at Copalis, 30 at Long Beach, and 19 at Moclips. Although levels can continue to fluctuate, a general down-

Continued page 4

Monthly Surveillance Data by County

February 1999* - Washington State Department of Health

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|---------------|--|----------------|-----------------|------------------|----------|----------|----------|----------|----------|--------------------|-----------------------|------------|-------------------|---------|
| | | 751:HI | ella | nglia hebajjis v | | | NOTE HE | ococcal, | , :5 | 105 ¹⁵ | Trydia Conorthea Alfa | | , Pesticides, les | |
| County | k.cdi | OB;HI Salmo | nella Shigel | io Hepati | Hepati | Mon.h | ", Menir | o Perli | in Ling | erculosis Chlar | mydia Gon | orthe AIDS | qesi | icides. |
| Adams | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0/# |
| Asotin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0/0 |
| Benton | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 1 | 0 | 0 | 0/9 |
| Chelan | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 1 | 1/6 |
| Clallam | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 0 | 0/0 |
| Clark | 0 | 2 | 0 | 13 | 0 | 0 | 0 | 0 | 1 | 47 | 5 | 0 | 0 | 0/# |
| Columbia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0/0 |
| Cowlitz | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0/19 |
| Douglas | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0/0 |
| Ferry | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0/0 |
| Franklin | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0/10 |
| Garfield | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0/0 |
| Grant | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0/7 |
| Grays Harbor | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 13 | 0 | 0 | 0 | 0/0 |
| Island | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 7 | 1 | 0 | 0 | 0/7 |
| Jefferson | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0/0 |
| King | 0 | 4 | 1 | 3 | 0 | 0 | 0 | 3 | 9 | 278 | 69 | 12 | 0 | 3/3 |
| Kitsap | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 38 | 7 | 2 | 0 | 0/8 |
| Kittitas | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0/0 |
| Klickitat | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0/0 |
| Lewis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0/7 |
| Lincoln | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0/0 |
| Mason | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 0/7 |
| Okanogan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 0/0 |
| Pacific | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0/! |
| Pend Oreille | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0/0 |
| Pierce | 0 | 3 | 0 | 2 | 1 | 0 | 0 | 0 | 6 | 141 | 29 | 2 | 1 | 0/4 |
| San Juan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0/0 |
| Skagit | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0/7 |
| Skamania | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0/0 |
| Snohomish | 0 | 1 | 1 | 5 | 1 | 0 | 1 | 0 | 0 | 66 | 4 | 6 | 1 | 0/7 |
| Spokane | 0 | 5 | 0 | 7 | 0 | 0 | 0 | 0 | 2 | 68 | 9 | 0 | 0 | 3/142 |
| Stevens | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0/0 |
| Thurston | 0 | 2 | 0 | 5 | 0 | 0 | 1 | 0 | 1 | 52 | 5 | 0 | 0 | 0/7 |
| Wahkiakum | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0/0 |
| Walla Walla | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0/10 |
| Whatcom | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 25 | 3 | 0 | 0 | 0/9 |
| Whitman | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0/7 |
| Yakima | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 11 | 0 | 1 | 0/17 |
| Unknown | <u> </u> | 1 | | <u> </u> | <u> </u> | <u> </u> | <u> </u> | <u> </u> | | 10 | | <u> </u> | ' | 1/10 |
| Current Month | 1 | 32 | 8 | 44 | 2 | 1 | 3 | 9 | 23 | 922 | 148 | 24 | 4 | 8/33 |
| February 1998 | 2 | 7 | 5 | 44 | 4 | 2 | 10 | 27 | 23 17 | 800 | 146 | 29 | 6 | 11/279 |
| 1999 to date | 1 | 34 | 9 | 44 | 2 | 2 | 6 | 11 | 40 | 1922 | 333 | 50 | 7 | 19/620 |
| 1999 to date | 2 | 34 7 | 5 | 48 50 | 5 | 2 | 0 16 | 29 | 40 29 | 1609 | 333 283 | 66 | 7 15 | 19/620 |
| 1770 IU UAIU | Z | 1 | ິນ | UU | ິນ | ۷. | 10 | ۷۶ | 29 | 1009 | ۷0۵ | UU | ıυ | 17/04 |

^{*} Data are provisional based on reports received as of February 28, unless otherwise noted.

† Unconfirmed reports of illness associated with pesticide exposure.

§# Number of elevated tests (data include unconfirmed reports) / total tests performed (not number of children tested); number of tests per county indicates county of health care provider, not county of residence for children tested; # means fewer than 5 tests performed, number omitted for confidentiality reasons.



WWW Access Tips

Additional information on domoic acid, including graphs of levels found in shellfish, is available on the Department of Fish and Wildlife Web page at: http://www.wa.gov/wdfw. Select the link for Fish and Shellfish.

Questions? Comments?

If you have a question about epidemiologic or public health issues, contact the editors at the address on the mailing panel or by email at function@u.washington.edu

Dose Estimates (from page 1)

information from their medical providers about the potential health implications.

The Hanford Individual Dose Assessment (IDA) Project (see epiTRENDS, March 1998) began processing individual dose request estimates in October 1998 based on information requested in two forms. The first form, mailed to approximately 45,000 households, asks for residence history, date of birth, gender, and related information. Replies are used to produce a second, personalized form that collects needed dietary information. Then project staff produce a dose estimate range, with a 90% likelihood that the dose falls within the range, and a median dose estimate. The results are returned by mail along with a resource packet of explanatory information.

To calculate dose estimates, the Hanford IDA Project is using scientific work and computer models from the Hanford Environmental Dose Reconstruction Project. The HEDR Project is a scientific study to determine what radioactive materials Hanford released in the past, where they went, how and when people were exposed, and the radiation doses they may have received.

The Hanford IDA project is sponsored by the state health agencies of Washington, Oregon, and Idaho with federal funding from the Centers for Disease Control and Prevention. The CDC informed the three state health agencies that it is correcting an error in the HEDR computer model that could affect dose estimate calculations for some persons. According to the CDC, the error underestimated Hanford's iodine-131

releases that occurred after August 1951. The corrected information is expected to be available in April, after which the first dose estimates will be mailed to respondents. Persons requesting estimates have told IDA project staff that this information is very important to them.

For more information on a particular project or study, contact the appropriate office listed below:

Hanford Individual Dose Assessment Project 1-800-432-6242; http://www.doh.wa.gov/ida

Hanford Environmental Dose Reconstruction Project; 1-800-545-5581

Hanford Thyroid Disease Study 1-800-635-4837; http://www.fhcrc.org/ science/phs/htds or www.cdc.gov/nceh

Domoic Acid (from page 2)

ward trend is evident, but it will likely be some months before clamming restrictions are lifted.

Ingestion of domoic acid causes amnesic shellfish poisoning (ASP), a potentially serious or even life-threatening illness. Symptoms include nausea, vomiting, diarrhea, or abdominal cramps with 24 hours of consuming the clams. Severe cases may manifest neurological symptoms within 48 hours. Suspected cases of ASP should be reported promptly to the DOH Office of Shellfish Programs. Contact Ned Therien at 360-236-3326 (nct0303@doh.wa.gov) or Patti Waller, 206-361-2914 (plw2303@doh.wa.gov).

The Department of Health Marine Toxin Hotline maintains updated information on beach closures; call 1-800-652-5632.

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